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OFFSHORE OIL AND GAS RISKS AND HAZARDS MANAGEMENT

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Abstract:
The design, installation and operation of an offshore platform can constitute a great danger and impact negatively on the safety of the marine activities. Features such as jack, spar, spacing as well as tower design can all have the potential likelihood and significances of numerus ocean risk and life-threatening hazard. This situation calls for an in-depth study of the conceivable risks and hazard that may play out in the oil and gas platform throughout the design, installation and operational phase. This journal aims at reviewing the possible hazard existing on the oil and gas platform using HAZID technique as the identifying framework.

Keywords: HAZID, Offshore Platform, Consequences, Probability

1.Introduction:

After decades of global offshore oil and gas exploration, risk and hazard still remain a subject of great concern with high demand in technology to control and mitigate the risk. On account of this, operational safety in the industry has become a critical issue in the factor of production. In recent time, this safety concern has advanced into methodical discipline with many extremely practical and multifaceted models and practices. Industries professional, experts and process Engineers has advocates for the engagement of appropriate and advanced high-tech apparatuses and equipment in gathering information for safety decision, as well as in plant design and operation. To achieve the measures under operational context, hazard identification methodology, HAZID is used. This is hazard assessment technique whose approach is on identifying system hazard and to regulate influences that can issue hazards measures as well as their consequences. Hazard identification (HAZID) is the most relevant and important step in offshore oil and gas risk assessment, a qualitative technique with a systematical process of identifying hazard and associated event that have the potential of causing great consequence. [1] acknowledged HAZID as the most appropriate risk assessment technique that can be employ in the oil and gas industry for the identification of hazard. Oil and gas safety can best be defined through the knowledge of the following basis:

Risk: This is the likelihood of a specified undesirable event occurring within a specified period or in a specified circumstance.

Hazard: This is any real situation with the potential of causing harm, injury, or damage to property, environment, or a combination of both.

Uncertainty: This is deficient in knowledge of the future event. According [2], the possibility is the curb in information or data concerning environmental influences and the factors of impacts that can affect them. Uncertainty originates from randomness and lack or incomplete information.

Risk Assessment: Risk assessment is a whole technique or process of investigating and estimating associated hazards in a system. It is a course of appraising consequences of danger in a project.

Risk Management: Risk management is the process of recognizing, examining, and deciding on a potential event within a negative impact on the asset, project, or environment.

Therefore, in oil and gas exploration, where heavy and highly combustible liquid is dispensed at a high frequency and constitute a hostile and dangerous environment for machines operation, safety remain a key word. Any act or event of accident can result in a colossal loss of lives, money, reputation as well as the environment. To protect all the stakeholder and the investment, safety structures must be industrialized and unified into the systems' operation in order to lessen the probabilities of any disaster.

1.1. Hazards and accidents within the Offshore Environment.

July 1988 at Piper Alpha oil production facility in the North Sea, something went wrong and 165 crewmembers plus 2 rescue men perished. March 2001, Petrobras P-36 drilling ship exploded killing 11 workers onboard. Deepwater Horizon explosion, April 20, 2010 with the loss of 11 lives. And Chevron Nigeria Limited oil facility explosion, January 20, 2012, two lives was lost, the list keep counting, all these were triggered or attributed to a potential hazard.

The offshore environment is unique both in installations and in operations, combine with multiples potential sources of hazards threatening the health and safety of workers. Constituting mostly of mechanically complex structures, the offshore oil and gas platform hazards ranges from fall related accidents, falling objects, rig workers fatigue as well as fire, explosion, cranes and heavy equipment and helicopter accident. These and others are all classified into biological, chemical, physical, psychosocial, ergonomic and safety hazards. To evaluate these, HAZID technique is the suitable tool as a multi-criteria decision analysis for analyzing the perceiving hazards existing on the platform. According [3], is consider so because the final outcome rest on criteria, that relate the possible unsafe scenarios with differs significances. Hazard that is overlooked in a system has the capacity of introducing more error into the general risk estimate of the system operation, thereby affecting the model and frequency estimate.

2. Earlier Research:

HAZID technique is a method of assessing hazards on oil and gas platform, its usually carried out in groups with the aim of digging deep into the likely hazards. [4] conducted a vibrant hazards assessment on Sirri gas facility using HAZID tool in identifying potential hazards on the petroleum platform. Harstad accentuated on the important of integrating HAZID into platform design and operation in oil and gas industry with a systematic guided methodology [5]. Similar study was conducted by [6] to extract the distinctiveness of HAZID in the engineering safety methodology by integrating HAZOP into the risk assessment procedure in maintaining the platform safety. According to [7], HAZID is the most consistence technique of hazards identification commonly used on variety of areas, projects and operations in the offshore environment. In this technique, a explanation of possible sources, properties and significance or gravity of conceivable chances are given to every hazards identified. The work of [8] was to reveal the likelihood of intrinsic safety in the hazard's consideration within the offshore activities while [9] stressed on the need to identified all possible conceivable hazard existing within the offshore environment.

On a modelling effort of LNG terminals, [10] through their investigation, concluded that, design work should be built on HAZID technique. [11] contribution was on the identification of possible gas discharge situations by steering a HAZID technique with attentiveness on differs characteristics within a gas turbine impulsion arrangement. Furthermore, [12] synopses the shell's risk assessment operational technique that

was designed toward practical safety and economical floating production system in delivering lubricant and LNG at the same production point.

In this review, the aim was to look at the conceivable hazards whose existence in offshore oil and gas platform will constitute a major threat to the platform operations.

2.1. Risk Assessment and Management

It is the assessed risk that is controlled, a danger that is not known cannot be measured, treated, or managed and that total elimination of a risk in a system can never be possible. Therefore, it is vital to have a proper risk management procedure in a scheme to control and manage all forms of risk. The achievement of any project hinges on mostly the risk response strategies used in the mitigation and management of such threats [13]. Therefore, the fundamental idea or principles in risk management is about managing risk efficiently [14]. According to [15], excellent and standard risk management will always result in several aids and organization benefits in different ways, that may include:

- By identifying a promising option for the sequences of events.
- Boast or give assurance in the attainment of the management objectives
- Better the organization probability of achievement.
- Minimized uncertainty.
- More detailed in prediction.
- We minimized the repetition of energy.

Project Management Body of Knowledge (PMBOK), a journal published by, institute of project management (IPM), identified risk management as one of the main focal points on project management. It also labelled it as the procedure that has to do with leading risk management development, identification, examination, responses, as well as monitoring and regulating a project 16]. From the opinion of [13] risk management in structure or building is considered a tedious chore as the aims incline to alteration throughout the project lifespan. It happens much because of the sensitivity of developments to irrepressible risks, curtailing from the variations in macro-environment—the involvement of many managers in the project value line and unique nature of construction procedure. Risk management on a project should be a combined process with every activity targeted toward identifying uncertainty, approximate their influence, and analyze every interaction. The aim is to enhance control execution and provide the needed feedback for the maintenance of the assets [17] Risk management built on the agreement of literature work exploits the following method as suggested by [18]

- Risk identification (what is going wrong).
- Risk valuation (what are the significances).
- Risk extenuation or mitigation.

The initial action in risk management is to identify the risk itself, and it must be defined before it is managed. The identification of uncertainty makes it to become a problem affecting the projects. It mentions the indications or signs from the previous knowledge with like cases that would apply to the present to avoid or better the chance of cooperating with the achievement of the project.

According to [19], building risk can be branded in different ways pending based on the risk, its impact, or the project stage. By categorizing risk, it divided into two principal sources, the internal threat and the external danger.

The first and rudimentary question/step in hazard identification is chastely qualitative commonly referred to as safety study. This step is aim in revealing of the plant and installation that demand more consideration. It then pertinent to provide answer to the basic risk analysis. The outcome of the analysis is then utilized in mediating the acceptability of such risk and in the verdict making process. The qualitative outcome or answer often gives birth to the second and the third question. Moreover, in tackling question two and three, the application demands the deployment of a quantitative techniques in the risk analysis, the stage which is referred to as risk assessment. The hazard control in recent time has gone deeper than the ordinary quantitative deliberation to a more exhaustive assessment vacillating from hazard identification to calculation of every individual and associated risks. These associated risks within the offshore platform can be view as follows:

- Acts of Sabotage
- Installations and moving vessels collision
- Man-made error
- Acts of Nature (Bad weather)

Offshore oil and gas operation always involve traditional dangers with potential of severe threat of accident, the danger of object drop from lifting and the operators from the height. Materials handling in drilling process, shipping and transportation, bad weather as well as explosion from fluid and liquid.

2.2. HAZID TECHNIQUE

HAZID is a hazard identification tool or technique that has gotten an early approval and application in the oil and gas industry, the industry project with an established process flow and plot layout diagram can enjoy the deployment of this tool. This technique is a design-enabling means premeditated to help shape the health and safety environment, (HSE), deliverables in the offshore project. It is an organized brainstorming technique that involve experts and engineering clients. Projects managers as well as commissioning and operations men.

2.3. ADVANTAGES OF HAZID

The target of an efficient HAZID research activities is to give a step-by-step identification of hazards in-order to guard against danger in different stages of the offshore operation. The benefits of HAZID study in handling environmental safety in the offshore oil and production can be summaries as thus:

- The tool facilitates in the discovering of hazards at its early stage of the project.
- Help in creating a consistence record of hazards for effective mitigation.
- It gives room for good auditing, effective managerial and legislative response
- It reduces hiccup and hinderances in budgeting and operation
- It strengthens the plant life-cycle.

3. HAZID METHODOLOGY

In this methodology, a checklist is established for all possible and perceived hazards on the offshore platform. This procedure of HAZID framework was set with the guide of significance literature [20]-[24]. In this method, a comprehensive study was carryout by suggesting every conceivable platform threat, sources and their expected consequences. The benefits of this are to aid in safety planning and eliminate threats in a day-to-day operation.

3.1. HAZARDS INDETIFICATION SHEET (HAZID Check list).

Table 3.1. Platform hazards

Types of Potential Danger	**Sources/causes**	**significances**	**Precautions**
Riser and Pipelines releases	Outside impact	Fire risk, ecological effect and release of contaminated substance.	Riser is interior to the casing /jacket assembly
			Fire and Emergency shutdown, Gas linkage detection devices.
			Navigation lights
			Air (Oxygen) apparatus
	Deterioration/Corrosion	Fire risk, ecological effect and release of contaminated substance.	Corrosion practices
			Pipeline description
			Coating
			Pigging
			Painting
Well blowout	Damage/ loss of well regulator	Fire risk, ecological effect and release of contaminated substance.	The blowout preventer through well interference. Operational engagement with subsurface safety valve (SSSV) and surface safety valve (SSV).
			Tolerable space on the deck for flexible rig process with differs equipment.
	Outside impact	Fire risk, ecological effect and release of contaminated substance.	Shutdown /close all fail SSSV and SSV.

Helicopter	Bad /dangerous weather	Crashing on the helideck with possible impact on platform.	Movement restriction on bad weather. Helicopter Saving kit
	Operator (pilot) mistake	Crashing on the helideck with possible impact on platform.	Good illumination and design of the helideck. Proper training and retraining of the pilot. Safety disposable.
Lighting	Tempest	Fire at the platform	Fire and Emergency shutdown, Gas linkage detection devices (ESD and FED systems). Flame arrestors.
Ship Collision	Drive and drift off	Influence/effects on constructions	Building of Barge bumper on the ship/boat landing terminals to sheath the impact. Improving platform design and construction.
Sea Growth	Failed or inappropriate material coating	System Corrosion and structures weakening.	Appropriate painting and coating. Sea growth preventer. Growth consideration during design and construction.
Turbulent wind and tide	Hurricane and cyclones	Effect on structures and drop objects	Appropriate platform design and construction with respect to weather condition. Weather limitation and control on cranes movement.
Hydrogen cumulation/ formation in the battery room	Drops of Hydrogen	Likely explosion	Good and open ventilation. Hydrogen detector. Fire extinguisher. Explosion proof equipment.
Chemical seepage	System failure	System damage	Fire and Emergency shutdown, Gas linkage detection devices (ESD and FED systems). Appropriate fitting and piping. First aid box provided
	Drop Object	System /Equipment damage	Trained and certified crane operative. Provision of first aid box.
Fatigue	Repeated loading on structures/systems.	Possible failure toward joints and structures/systems.	Fatigue analysis should be considered in the design criteria.
Earthquakes	Natural mishap	Effects on platform structures and personnel with high/low impacts	Considering the seismic zone standards in the platform structures' design.
Accidents/dangers from process equipment	Drop equipment	Impaired equipment, falling-out pipe discharging toxic fluid, fire risk and ecological impacts.	Provide hydrogen sulphide (H_2S) detector. Fire and Emergency shutdown, Gas linkage detection devices (ESD and FED systems).

			Trained and certified crane operative. Material handling guide. Inundation system Constand review and certification procedure for crane operation. Braided main deck.
	Valve mechanical failure	Fire risk, ecological effect and release of contaminated substance into the environment.	Provide hydrogen sulphide (H_2S) detector. Fire and Emergency shutdown, Gas linkage detection devices (ESD and FED systems). Regular inspection and maintenance. Carry out leakage test before daily operation. Inundation system. Braided main deck. Appropriate piping and fitting.
	Corrosion	Fire risk, ecological effect and release of contaminated substance into the environment.	Fire and Emergency shutdown, Gas linkage detection devices (ESD and FED systems Appropriate piping and fitting. Coating/Painting.
	System Failure/breakdown	Fire risk, ecological effect and release of contaminated substance into the environment.	Fire and Emergency shutdown, Gas linkage detection devices (ESD and FED systems. Conduit design criteria and specification.

4. RESULT AND DISCUSSION

After area cataloging, hazard determination and the HAZID checklist, a consequences and probability matrix were used to access and evaluate the risk level of the hazards as it relates to HSE. The matrix demonstrated the probability (likelihood) as it related to the to the consequences (impacts). The hazard was identified and their risk yield was assessed based on the HAZID procedure and finally classified and grouped into five levels (**Fig.2**). Another importance of the matrix is that, it communicates the severity of these hazards at every level for necessary and rapid respond.

Consequence						
	5	Mild	Serious	Very Serious	Very Serious	Very Serious
	4	Insignificant	Mild	Serious	Very Serious	Very Serious
	3	Insignificant	Insignificant	Mild	Serious	Very Serious
	2	Good	Insignificant	Insignificant	Mild	Serious
	1	Good	Good	Insignificant	Insignificant	Mild
		1	2	3	4	5
		Probability				

Fig.2.1, The Consequences and Probability Evaluation Matrix.

5. CONCLUSSION

At the end of the reviewed, the study demonstrates a significant footstep towards offshore oil and gas platform hazards identification. Also, it integrates entirely, the likely existing threat or danger identification technique, which are indeed needed as changes in making flexible this hazard technique. A plan is projected to tackle most of the hazards and an evaluation process well-thought-out in solving the analyzed hazards. In this reviewed study, some specific hazards were identified and considered to be in level (5) of 'very serious' impact, such as Riser pipeline, well blowout as well as Chemical seepage, all constituting high impact sensitivity. Hence, it is of safety advice that, at this point, proper and immediate consideration should be made in place in order to curtail any pertinent danger. This study did not analyze the used software and types of software used in analyzing these hazards.

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